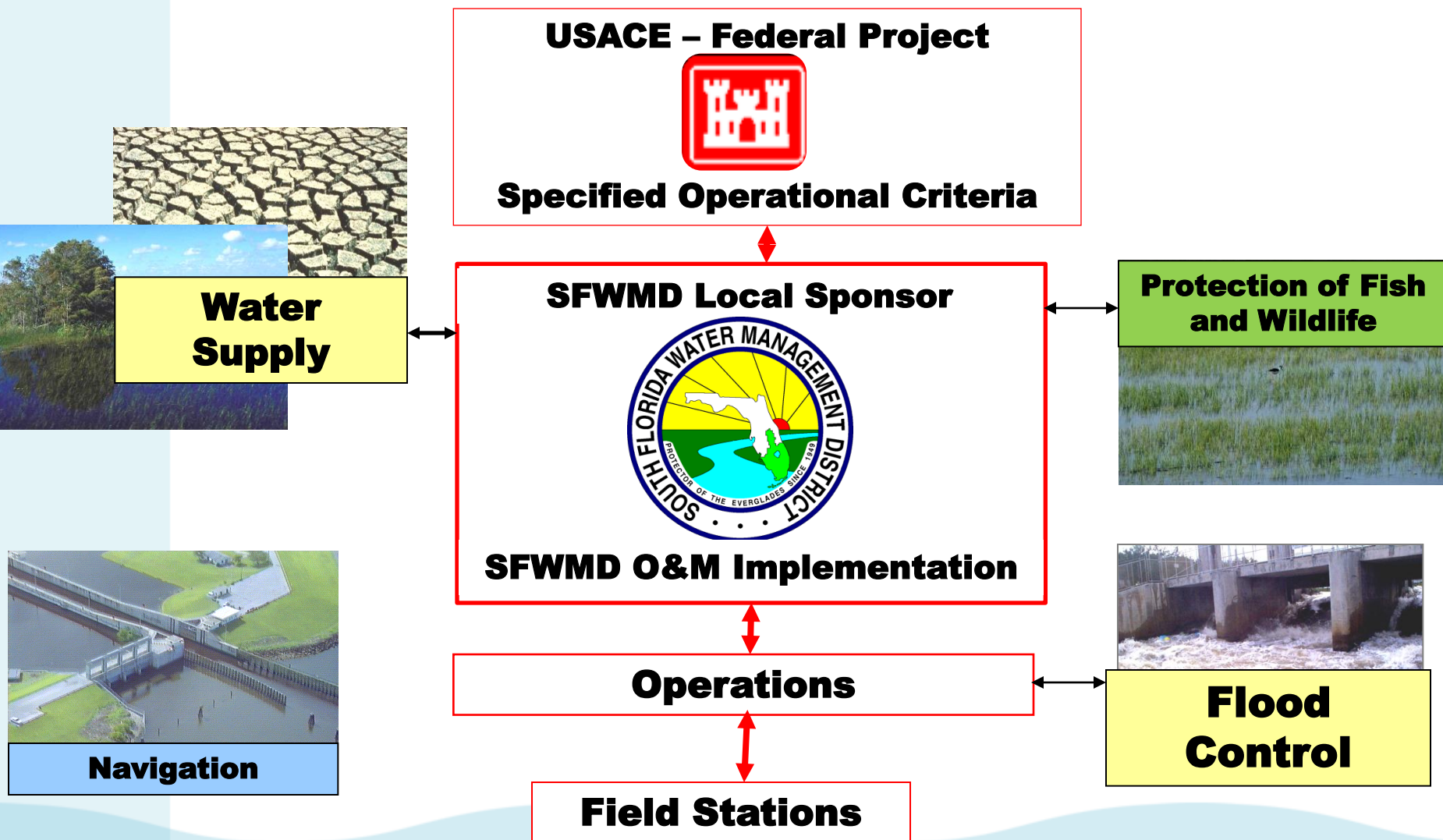


A System Within a System: Operating the System

Susan Sylvester
Department Director
Operations Control &
Hydro Data Management

C&SF PROJECT for Flood Control & Other Purposes



**“ORIGINAL”
C&SF SYSTEM**

300 Water Control Structures

**200 Operable Structures
25 Pump Stations
75 Culverts and weirs
1000+ Project Culverts**

2004-05 SFWMD Aerial Photography
2009 Monroe County Aerial Photography

Estimate of pre-2000 numbers

HISTORIC FLOOD CONTROL OPERATIONS – Example S5A into WCA-1

EAA

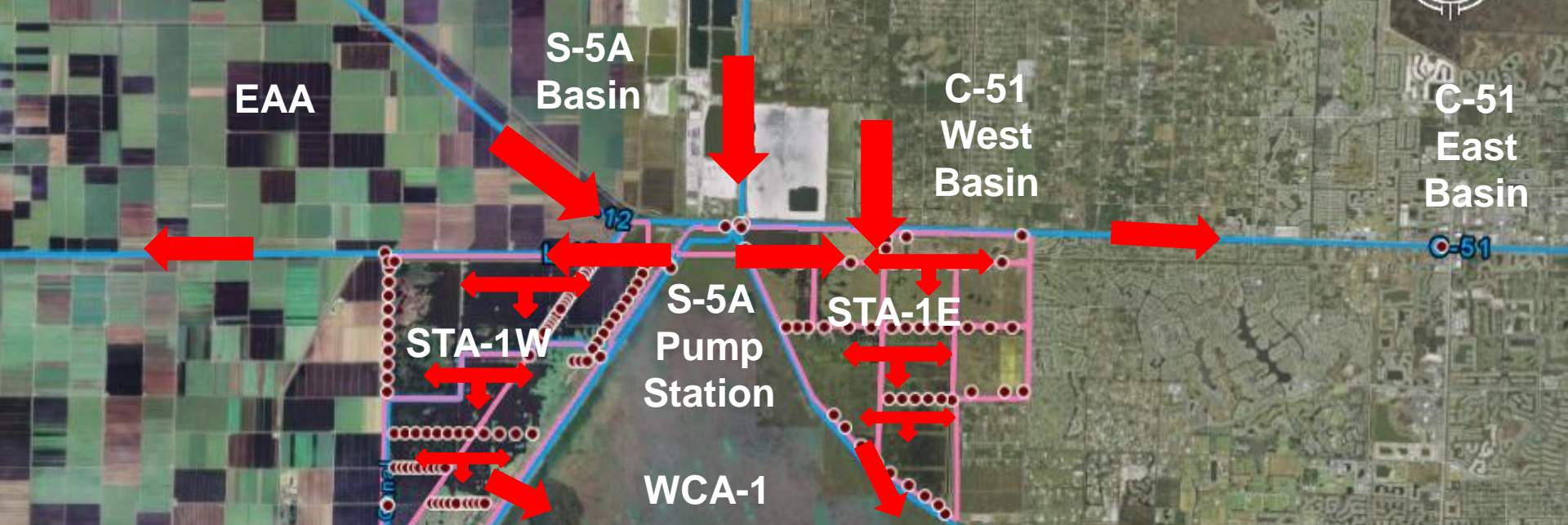
C-51
Basin

FLOOD CONTROL:
When it rained a pump station was turned on or a spillway gate was opened. There was less need for coordination during an event because the criteria was relatively simple.

S-5A
Pump Station

WCA-1

TODAY's **COMPLEX** MULTI-PURPOSE WATER MANAGEMENT OPERATIONS – Example S5A into STA 1W or STA 1E or to Tide via C51



FACTORS AFFECTING OPERATING DECISIONS:

Stormwater Treatment Areas:

- How deep can the water be?
- How fast can the water be allowed to move through the cell?
- Is there any species of concern that would limit flow (Black neck stilts)?
- Are there STA cells offline for maintenance?
- Is treatment capacity available?
- What is the likelihood of a diversion?
- Any special permit issues?

Other Factors:

- Flood potential for EAA & western C-51
- Does eastern C-51 have capacity?
- L-8 Reservoir diversion/discharge
- Lake Okeechobee releases
- City of West Palm Beach & 298 District operations
- Has the proper agency coordination been made?
- All parties notified?
- etc

2010 SYSTEM

653 Major Water Control Structures

- 411 Gated Culverts
- 110 Gated Spillways
- 66 Pump Stations
- 17 Locks
- 49 Weirs
- 2,669 miles of Canals
- Berms and Levees



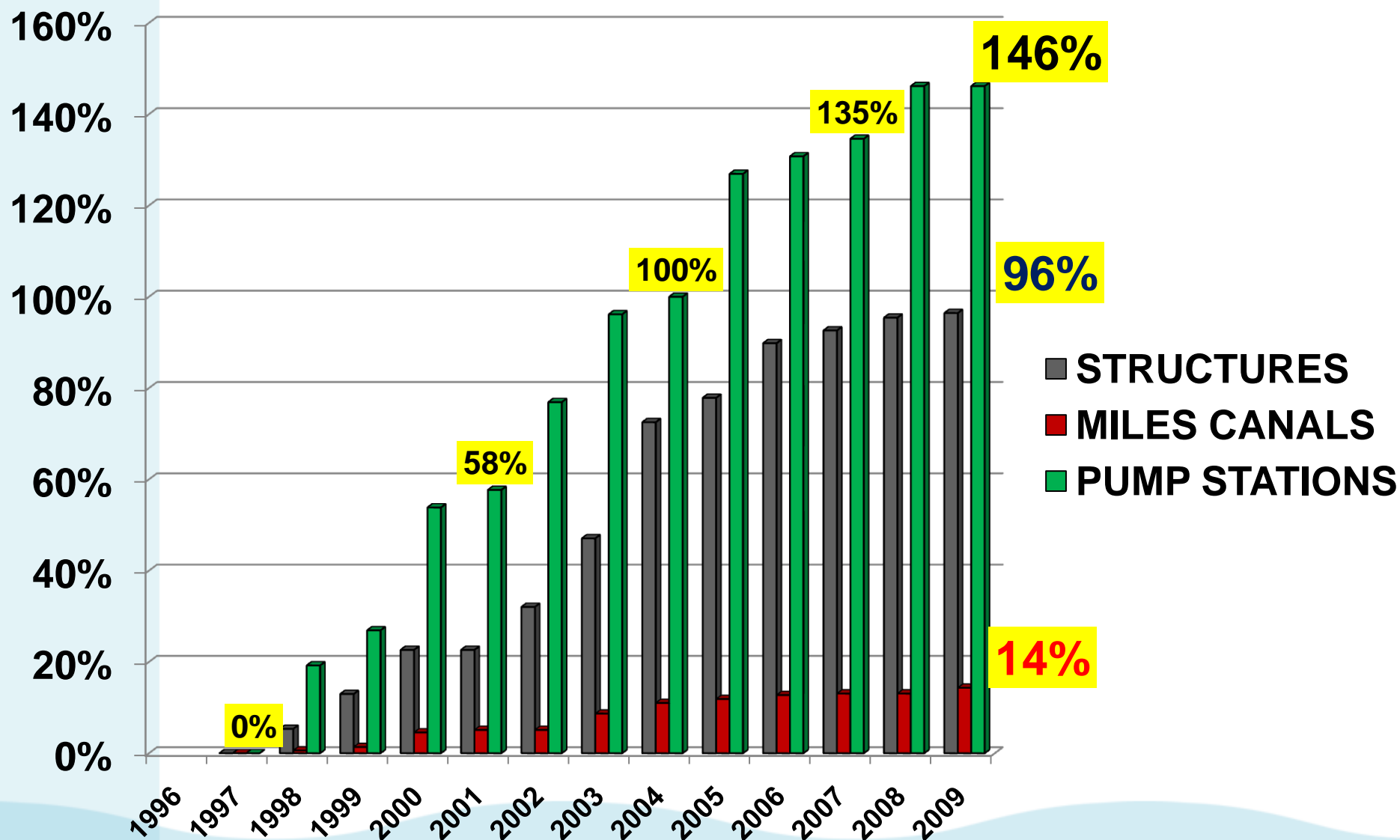
Active flow site



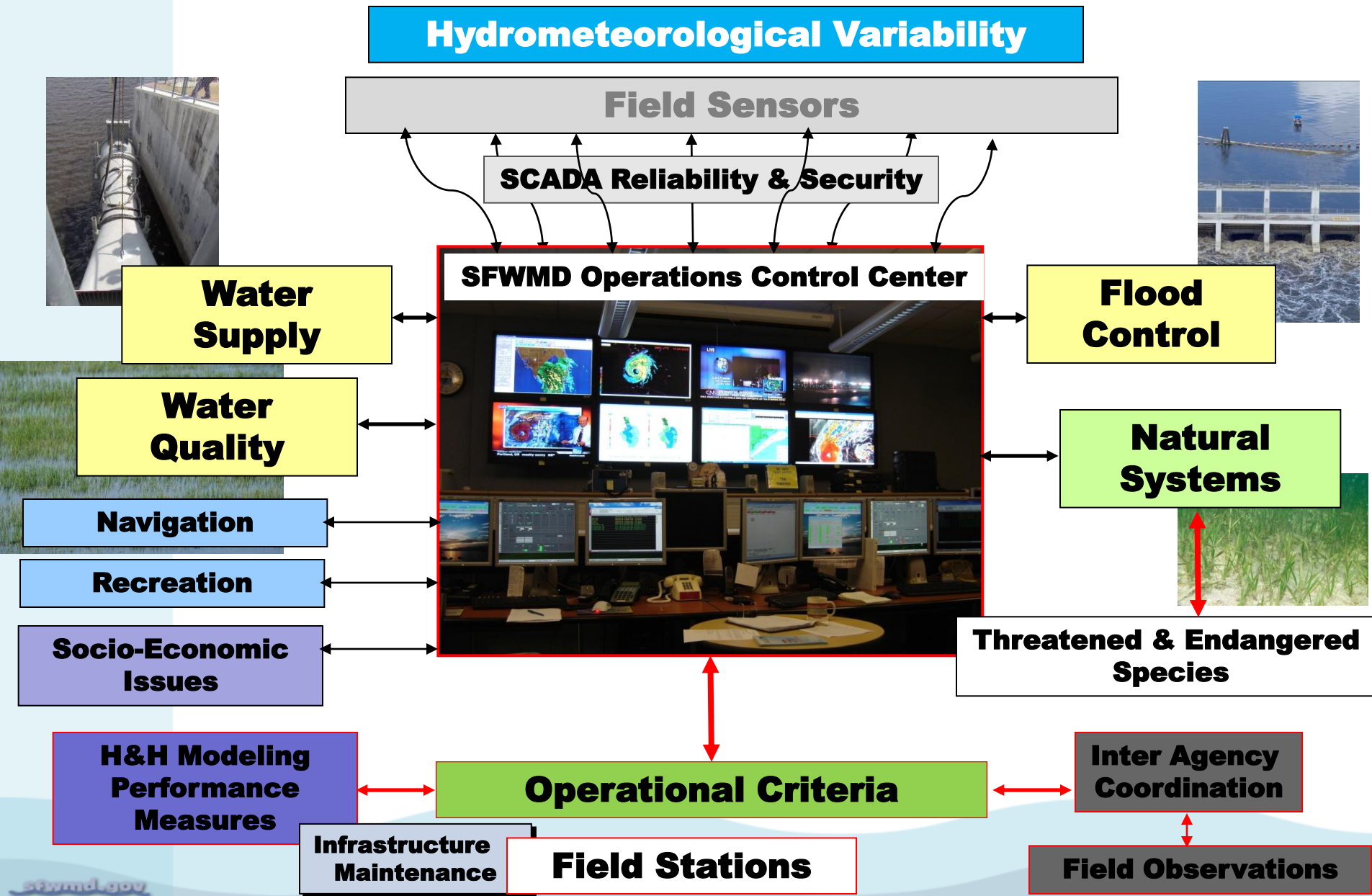
Active pump station

322 of these are in STAs

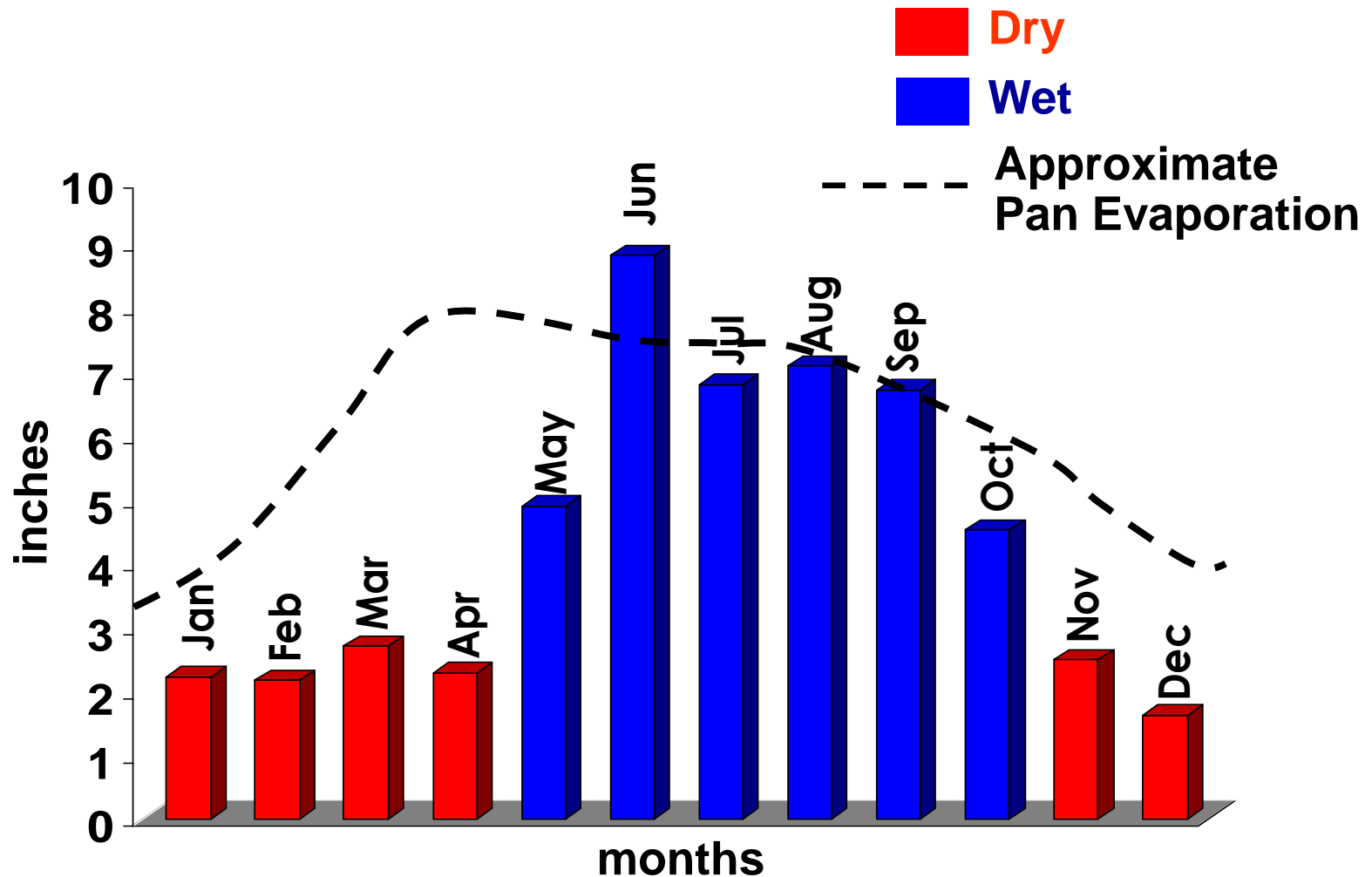
Infrastructure Growth 1996 - 2009



2010 C&SF PROJECT "Complexities"

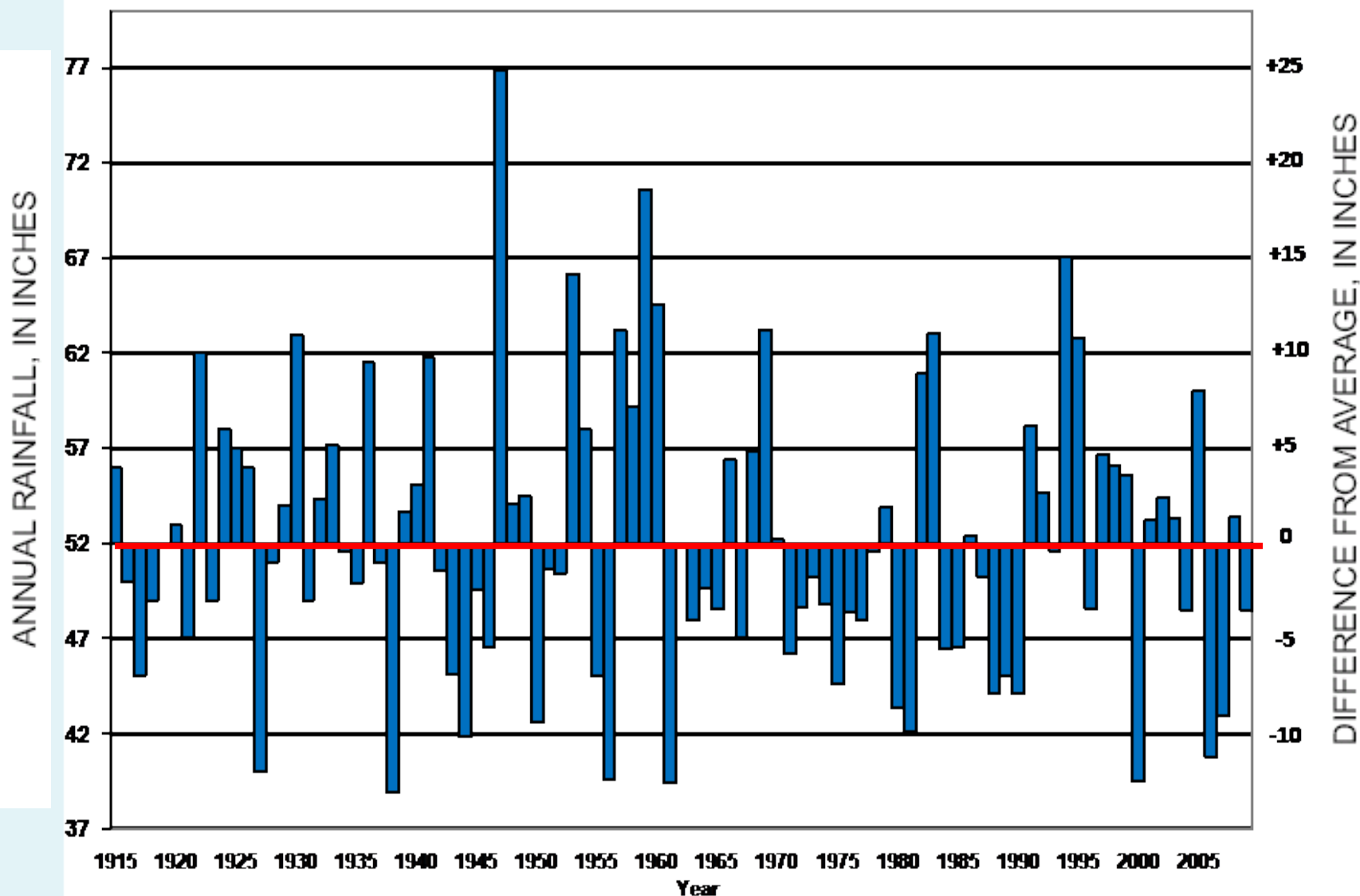


Seasonal Variation of South Florida Rainfall



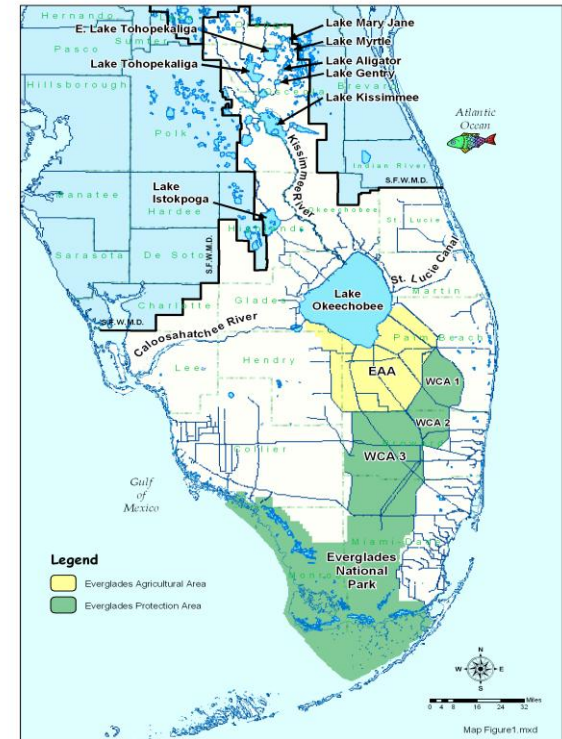
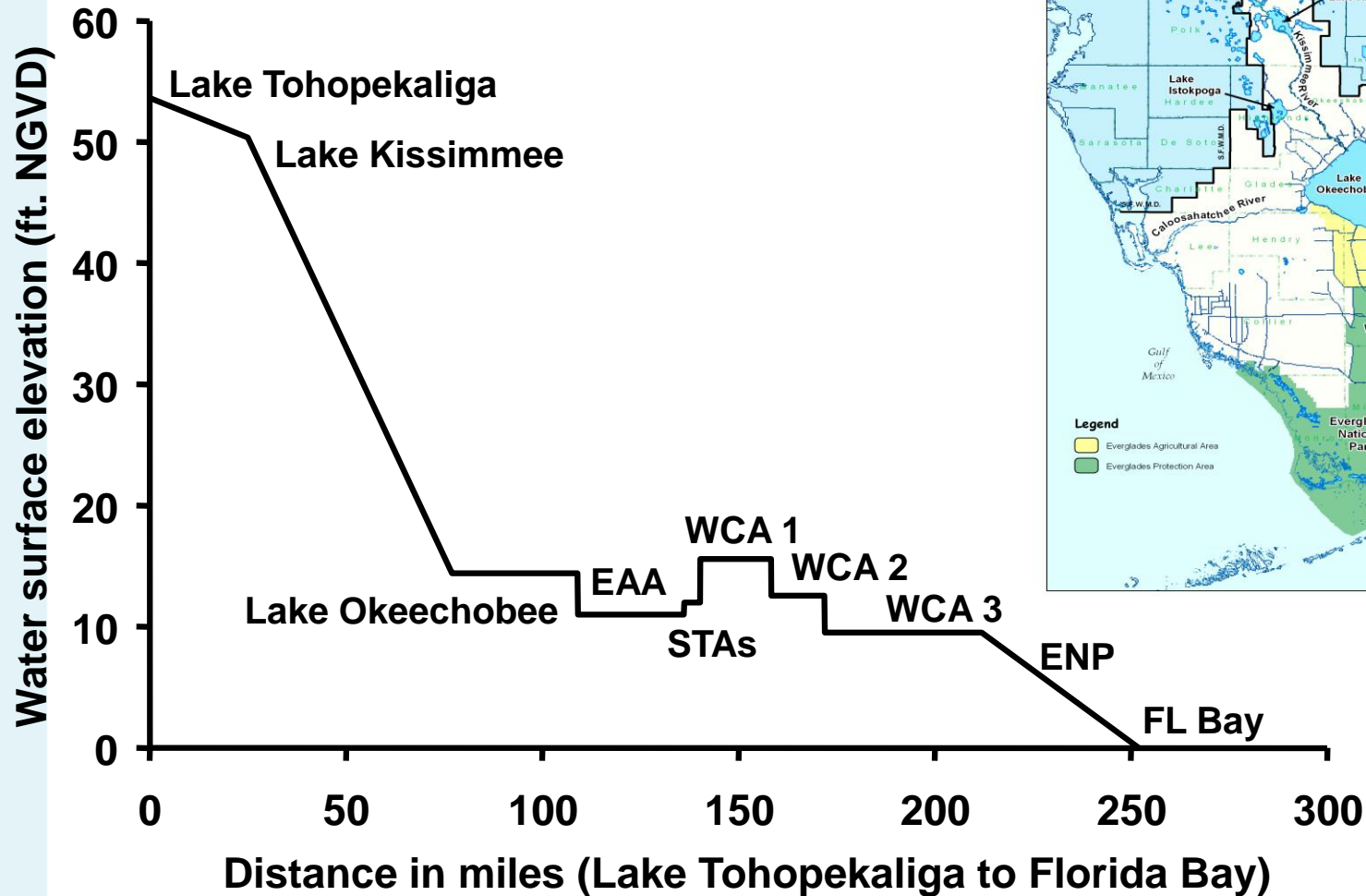
Average Monthly Rainfall 1965-1995

SFWMD Annual Rainfall and Anomalies (1915-2009)

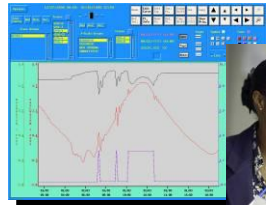
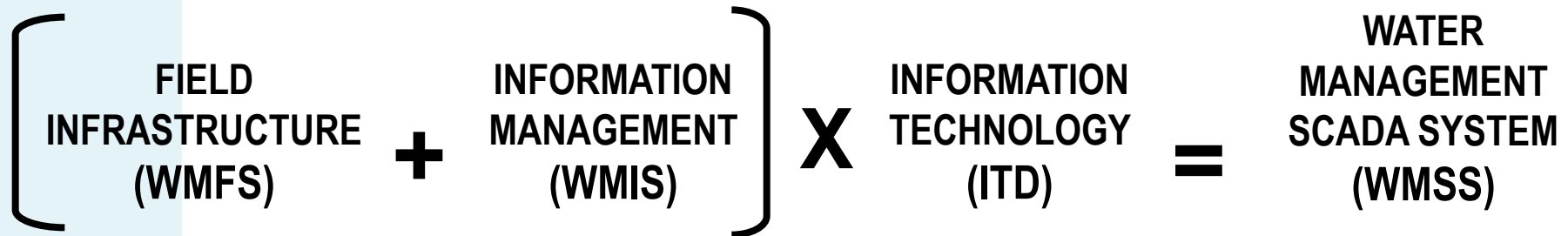


Rainfall above and below the average annual of 52 inches

Hydraulic Gradient Based on Historical Average Stage



How does SFWMD manage the system?



Remote Terminal Units (RTUs)
 –RACUs, MOSCADS, CR10s
 Sensors–environmental, structure
 monitoring
 Actuators–pump, gate control
 Data acquisition, test, maintenance,
 problem-tracking systems

Data management/warehousing
 Data verification and validation
 Quality control/quality assurance
 Analysis, Web publishing
 Database - DBHYDRO

Microwave backbone
 Spread-spectrum
 RF feeder networks
 District WAN interfaces (T1,
 etc.)

SCADA (Supervisory Control and Data
 Acquisition)
 Software/hardware systems for data
 acquisition and control
 System administration / Software
 development
 Operations Control Center (OCC) staff
 Water managers / SCADA technicians
 Meteorologists / STA Site Managers

ModComp to Telvent conversion
 Operation Decision Support System
 (ODSS)

How operational decisions are made

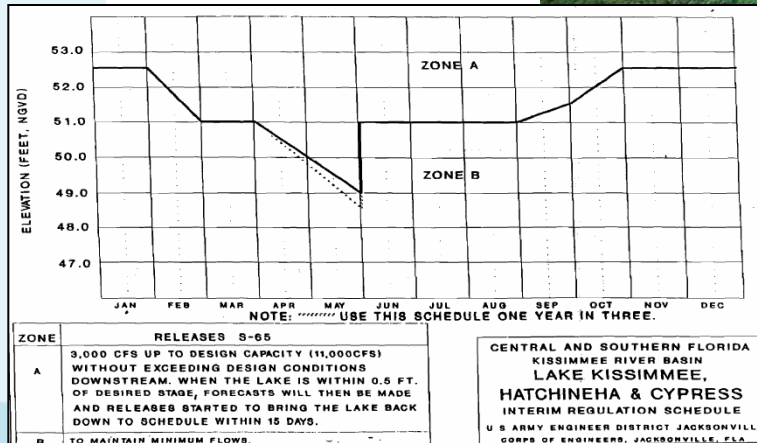
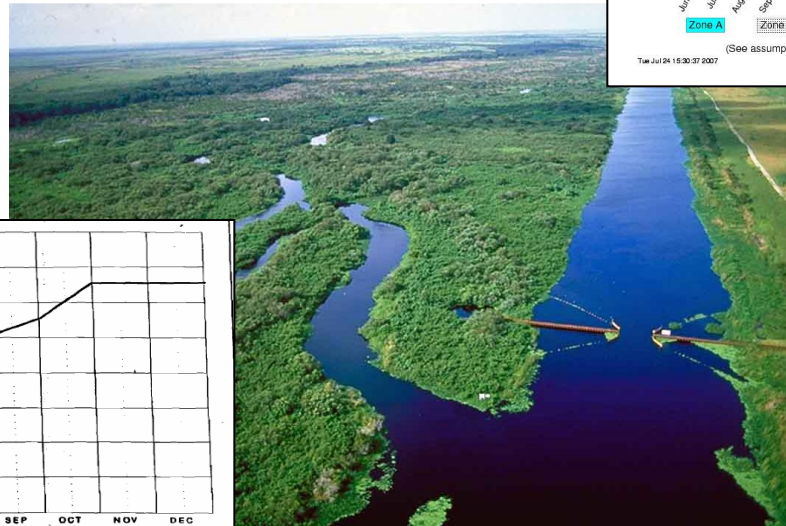
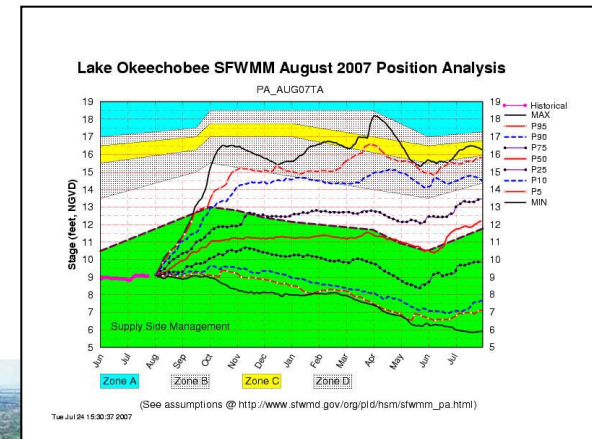
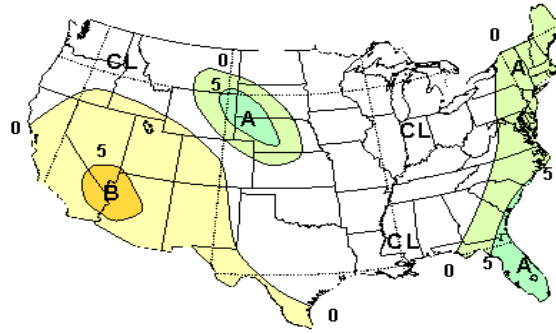


September 20, 2000

Climate Prediction Center

National Centers for Environmental Prediction
National Weather Service

We serve the public by assessing and forecasting the impacts of short-term climate variability, emphasizing enhanced risks of weather-related extreme events, for use in mitigating losses and maximizing economic gains.



Supervisory Control and Data Acquisition - (SCADA)



Remotely Operated Structures

- Canal levels are monitored through extensive network of gages
- Structures have automatic control
- Rainfall is monitored and amounts are forecasted daily
- Canal level optimum generally measured at structure upstream water level.
- Primary Modes
 - Flood Control
 - Water Supply

Remotely Operated Structures

Operable Culverts



Spillways



Pump Stations



Weirs





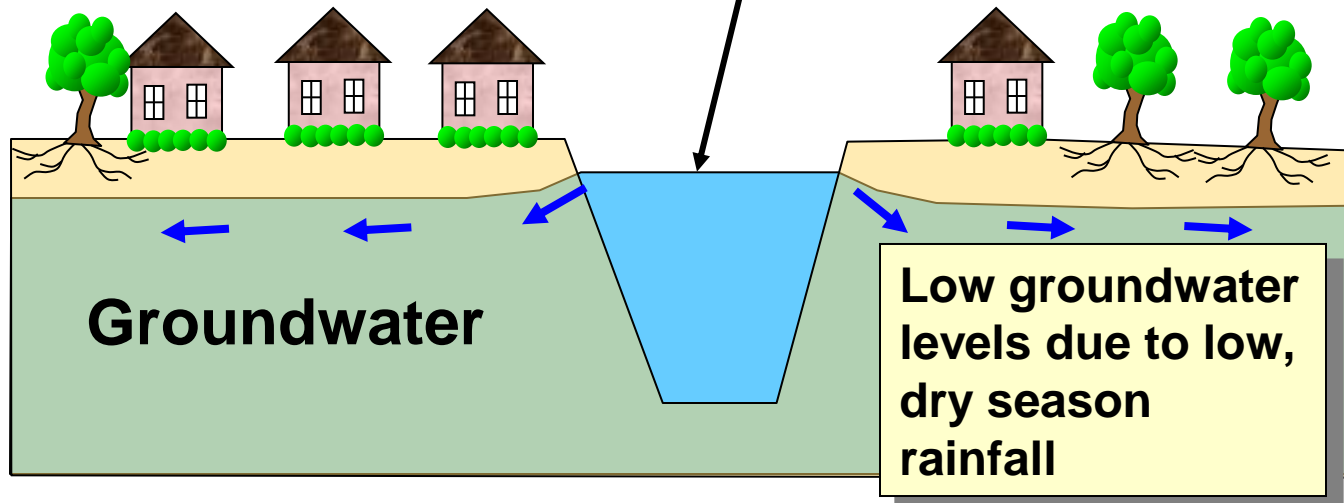
Canal / Groundwater Interaction

Normal Dry Season Operations

Canals serve two primary purposes....

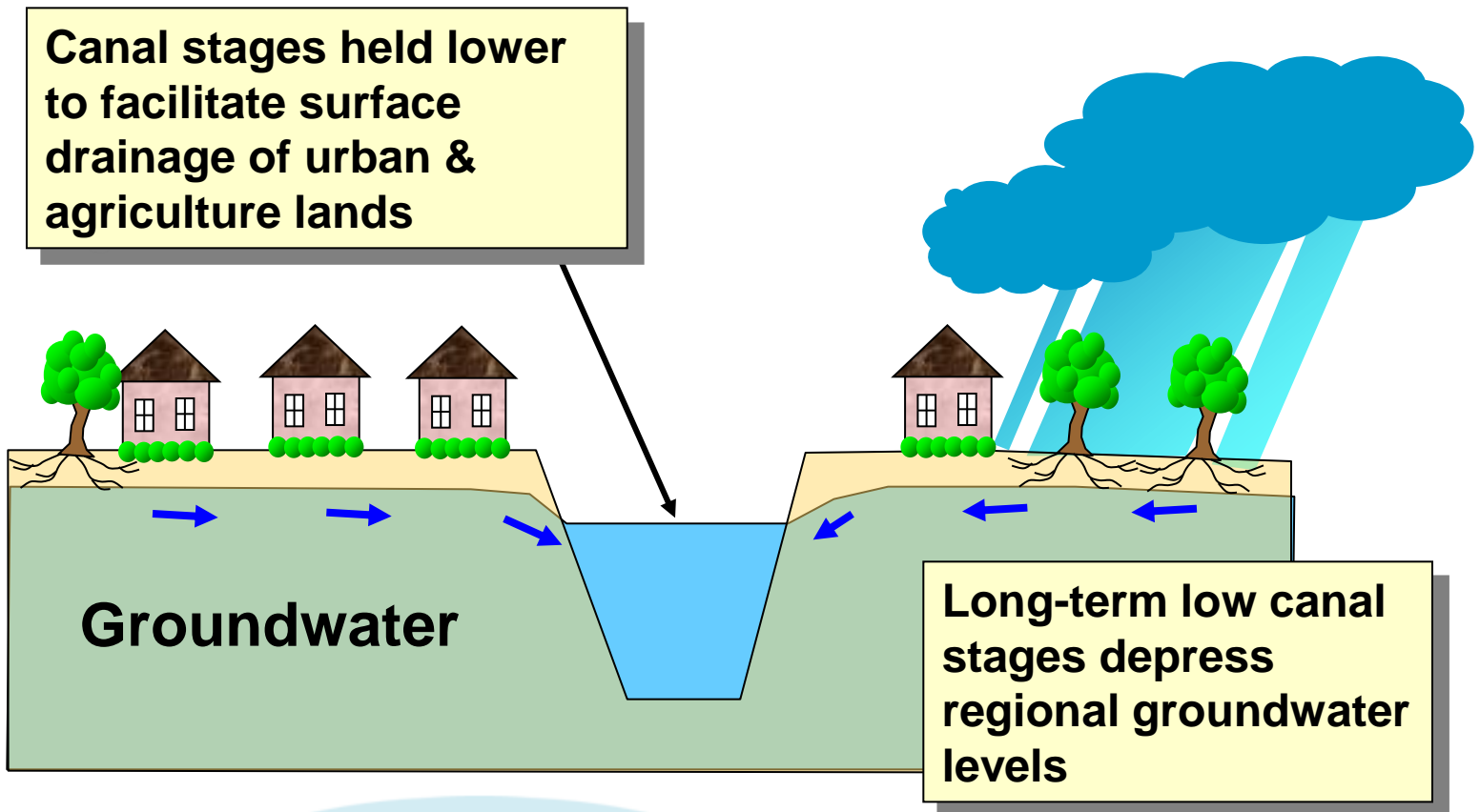
1. Flood Control
2. Water Supply

Canal stages held high to facilitate groundwater recharge and assist supplemental irrigation



Canal / Groundwater Interaction

Normal Wet Season Operations

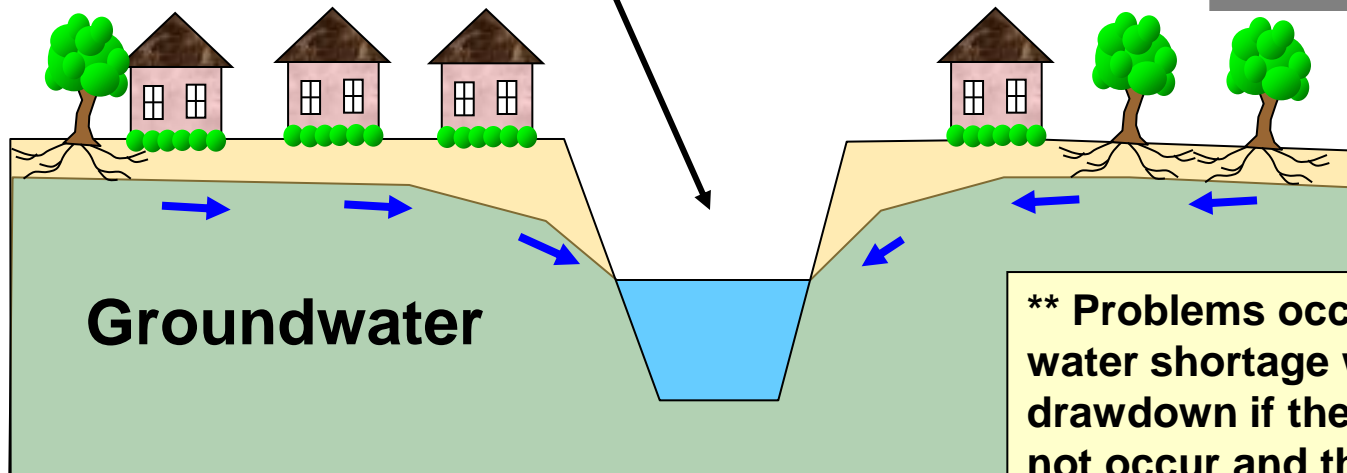


Canal / Groundwater Interaction

Wet Season Pre-Storm Drawdown Operations

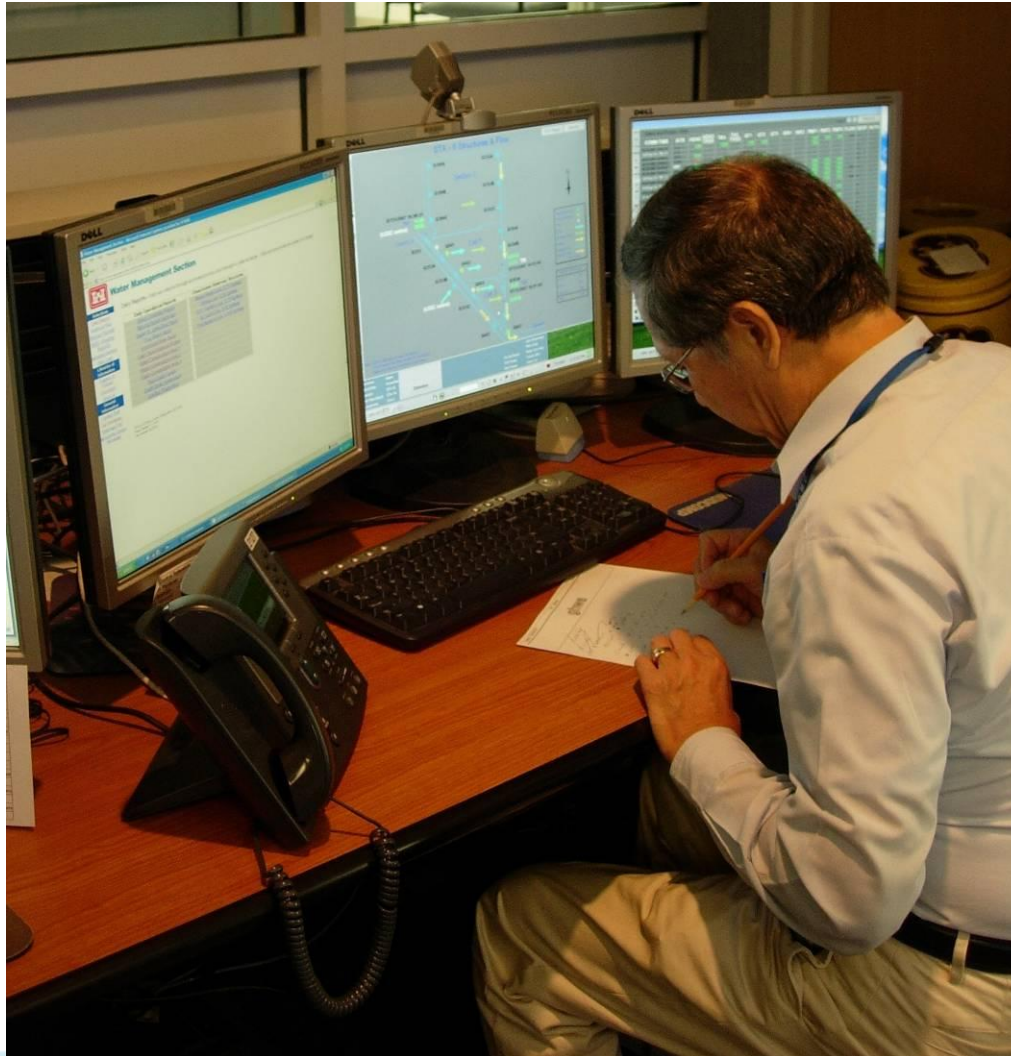
Canal stages lowered up to an additional ~1 foot to increase surface drainage of urban & ag lands prior forecasts storms

Short-term lowering of canal stages generally does not** significantly decrease regional groundwater levels.

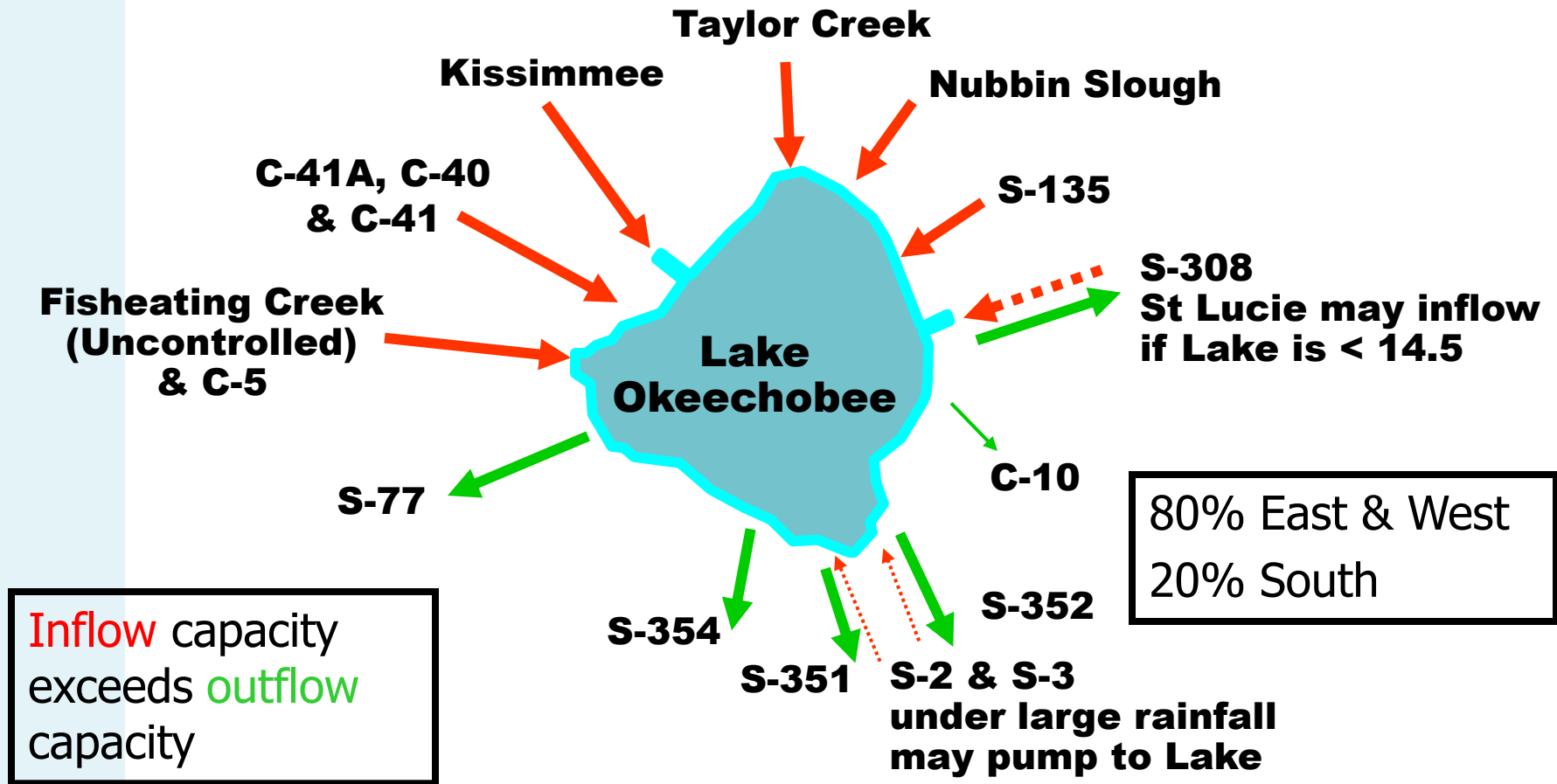


**** Problems occur during a water shortage with pre-storm drawdown if the rainfall does not occur and the water is lost from the system.**

Decisions, Decisions, Decisions...



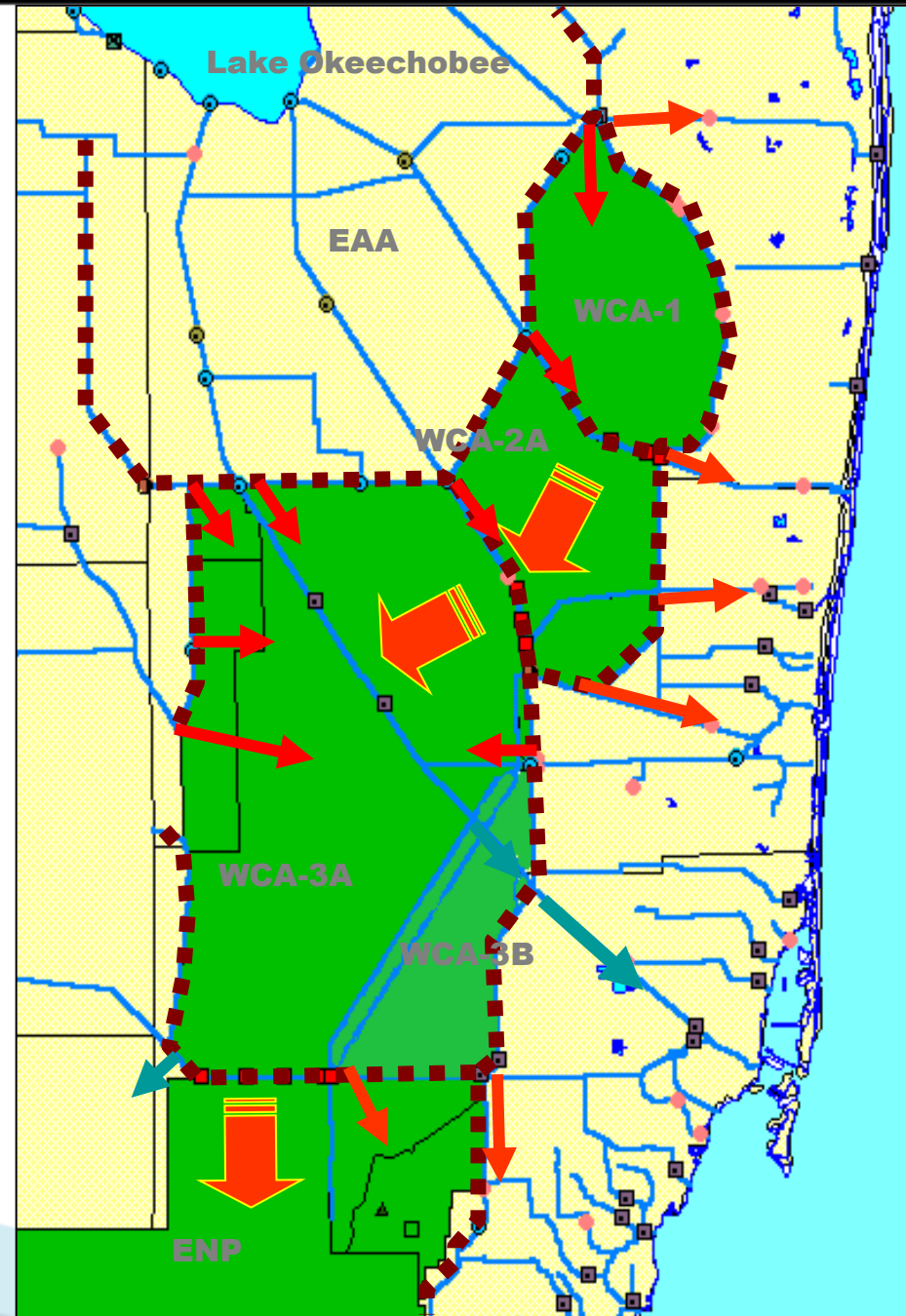
Inflows & Outflows



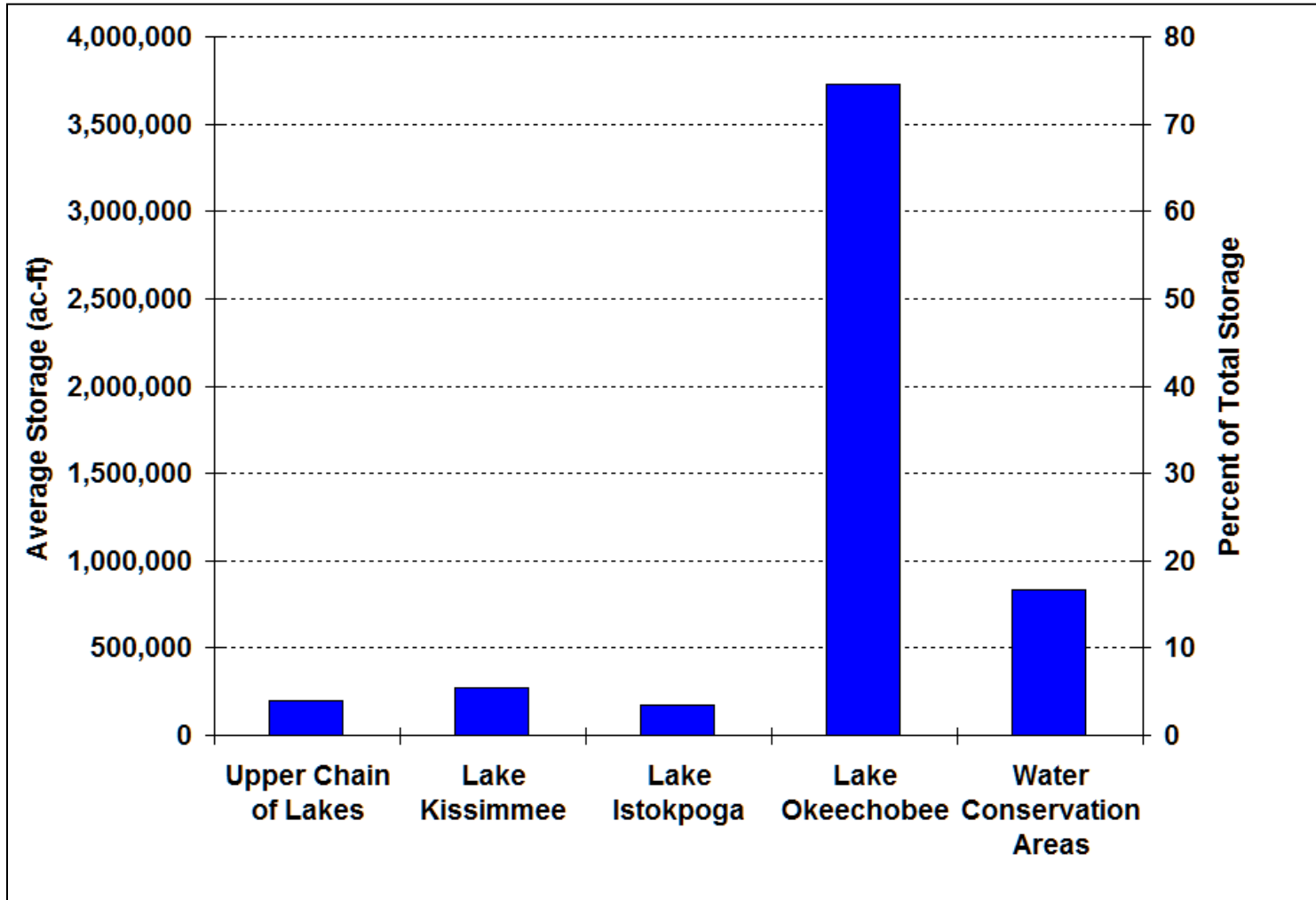
Lake Okeechobee's drainage basin covers more than 4,600 square miles

Everglades Protection Area Flow Patterns

- Levees surround the Water Conservation Areas
 - Primary inflow sources
 - EAA Drainage
 - Lake Okeechobee
 - Flood control discharge
 - Water supply to Lower East Coast
- Major structures move excess water south
- Smaller structures can discharge some excess water to the ocean
 - Provide water supply to maintain coastal canals



Average Storage in Lakes and Water Conservation Areas



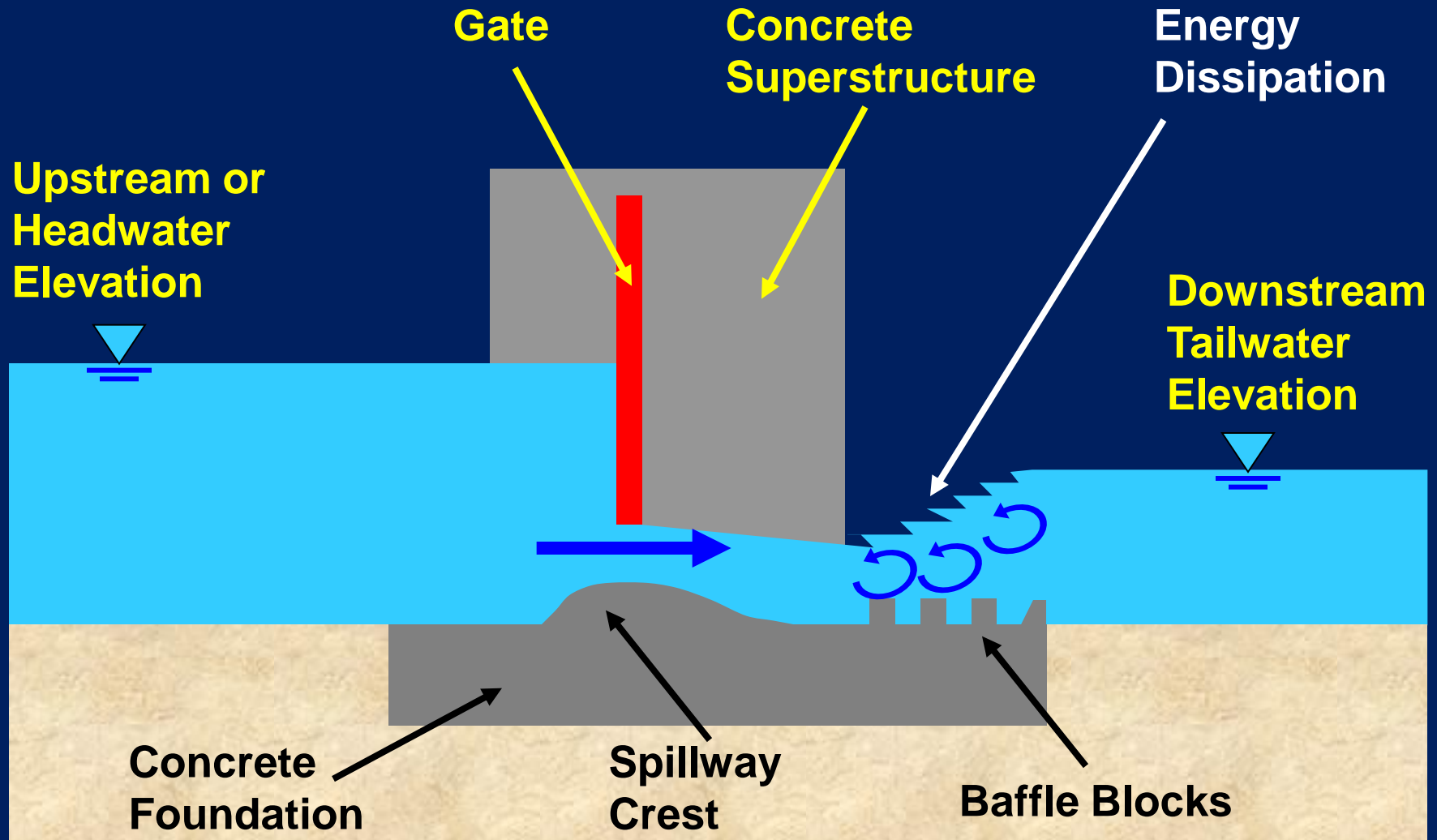
Summary

- Original C&SF system designed to allow rapid response to rainfall by using pump stations, Lake Okeechobee, Water Conservation Areas & Coastal spillways to provide flood control.
- Complex C&SF system includes Environmental, Statutory and Other Legal Mandates that have increased the challenge of water management.
- Multiple coordination, adjustment and contingency is required in order to meet multi-purpose objectives while providing same level of flood control.

Questions

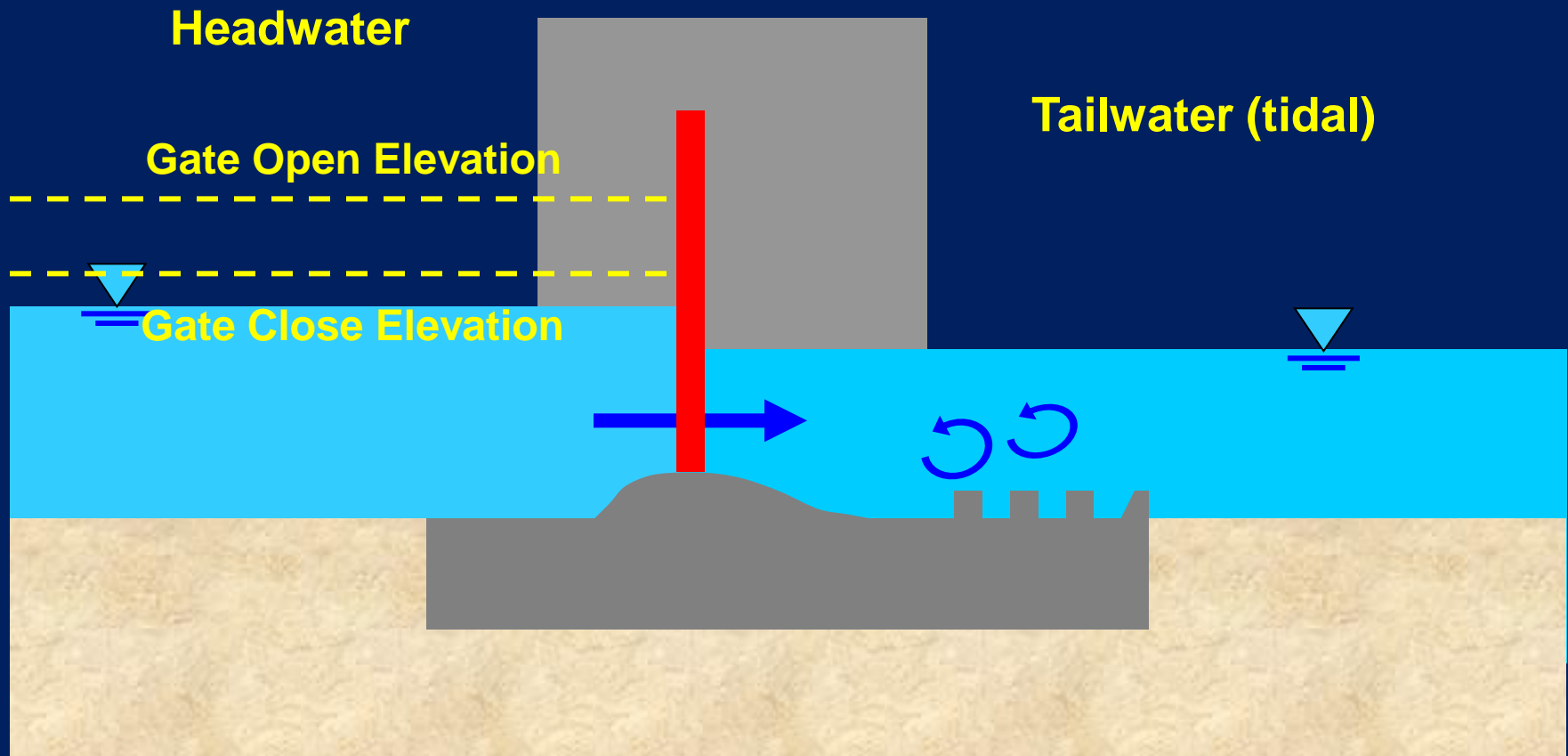


Gated Spillway Basics



Gated Spillway

(coastal structures)



Gated Spillway

(coastal structures)

